

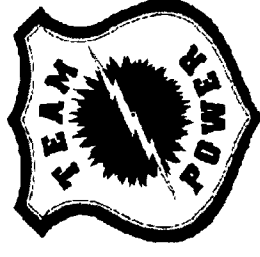
VRLA Battery Technology for Military Vehicle Applications

***Presented to the
Advanced Automotive Battery Conference 05***

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United States Army RDECOM

13 June 2005

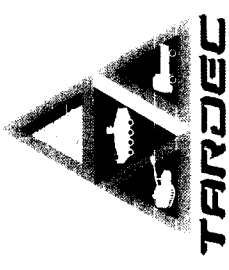


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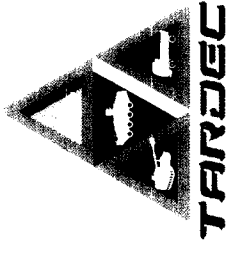
Agenda



- Status Quo: 6TMF Battery
- Changes in Vehicle Battery Usage Profiles
- AGM Battery Evaluations
- Pros & Cons of AGM Battery
- VRLA Specification: MIL-PRF-32143
- QPL Efforts



Status Quo: 6TMF Battery



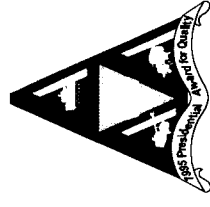
- Flooded Lead-Acid
- NATO Standard Size
- Fits >95% U.S. Military Vehicles
- 120 Ah (C/20)
- “Maintenance Free”
Pb/Ca Grid Technology



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Traditional Battery Usage Profile



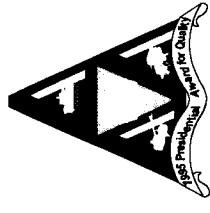
Typical military trucks traditionally:

- **Used vehicle batteries for powering Starting, Lighting, and Accessories**
- **Used vehicle batteries to power radios**

A vehicle battery's deep discharge cycling capability was of little value for most tactical vehicle applications.



Today's Battery Usage Profiles



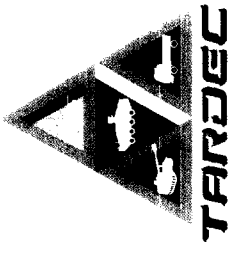
**Many military vehicles today use
vehicle batteries for powering:**

- Starting, Lighting, Accessories
- Electronic equipment suites
- Extended “engine-off” operation
 - Silent Watch

**The vehicle battery's deep discharge cycling performance
is critical for many modern vehicle applications.**



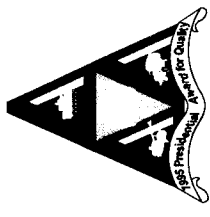
AGM Battery Evaluations



- Initial Safety testing completed, March 2001
- Limited field testing Ft. Hood, August 2001
- Profiling to modified FLA spec completed Oct. 2001
- Larger Ft. Hood/Ft. Carson field test initiated July 2002
- Various laboratory cycling tests, April 2001 - present



AGM Battery: Pros & Cons



Pros:

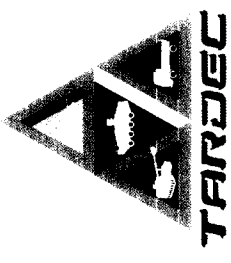
- Maintenance Free/ Longer Service Life
- Air Transportable
- Filled and Charged at factory
- Significantly longer shelf life (2+yrs vs. 6+ month)
- Deep Cycle performance: improved engine-off capabilities
- No stratification effects
- Direct replacement to the 6T series

Cons:

- Cost: Sole source item currently being procured by DLA as a commercial item (\$232 vs. \$68)
- Weight: 13-16 lbs heavier than the flooded 6TMF
- Reduced Performance/Life when mixed with 6TMF (Not recommended)



Procurement Strategy

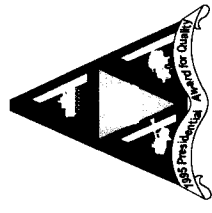


To promote competition and lower unit cost, a performance spec was developed for VRLA batteries with the ultimate goal of developing a Qualified Products List. (QPL)

- Performance Specification developed, Feb 2004
- Solicitation to Industry, Feb 2004
- Qualification Testing began August 2004



Comparison of Key Battery Spec Requirements



Requirement

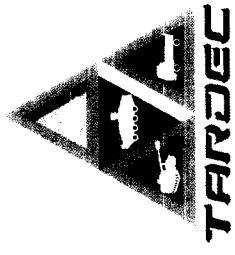
6TMF

VRLA

Nominal Weight	34 kg	40.5 kg max
Full Charge Capacity	120 ah	120 ah
Reserve Capacity(min)	200 minutes	230 minutes
Low Temperature Capacity (min) (discharge time to 7.2 volts) -18° C: - 40° C:	725 amp 30 sec 350 amp 30 sec	800 amp 30 sec 400 amp 30 sec
Life Cycle Capacity (min)	235 cycles	360 cycles
Retention of Charge: (min) Reserve Capacity after 60 days: Reserve Capacity after 90 days:	175 minutes	200 minutes
Vibration Resistance (min) Reserve Capacity	190 minutes	219 minutes
Deep cycle capacity (min)	N/A	120 cycles
High Temperature Cycling (min)	N/A	200 cycles
Induced Destructive Overcharge (min)	N/A	Applies



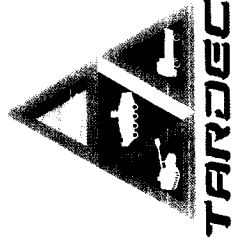
QPL Status



- Multiple vendors have expressed interest in submitting battery samples for Qualification.
- Qualification testing is underway for two sets of battery samples.
- When two different vendors have successfully completed Qualification testing, the QPL will be established.



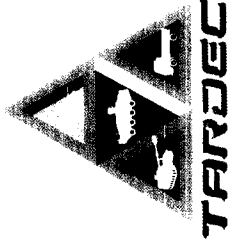
Conclusion



- VRLA batteries offer some desirable performance advantages for military vehicle applications.
- The Army is looking for alternative sources of supply for military-sized VRLA batteries.
- Copies of MIL-PRF-32143 are available to potential suppliers of VRLA batteries.



Thank-you!



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